Mount Diablo Astronomical Society

Diablo MoonWatch

February 2011

General Meeting

Tuesday February 22nd, 2011

Portraits of Distant Worlds:

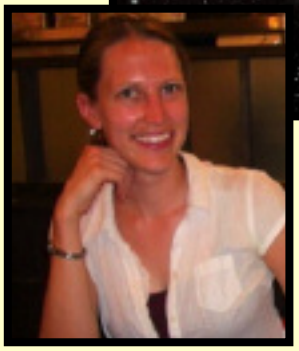
Characterizing the Properties of Extrasolar Planets

by Dr. Heather Knutson

Today we have detected such a multitude of planets orbiting other stars. Doppler wobbles and subtle photometric dips are adding to the list almost daily. The wonder, however, does not stop at exoplanet detection. Today, researchers like Dr. Heather Knutson are beginning actually to firm up details of these far off worlds.

Please join us Tuesday February 22nd as Dr. Heather Knutson will describe and explain the latest research and findings regarding exoplanets.

The past decade has marked a period of great progress in our quest to discover and characterize the properties of the planets outside of our own solar system. We currently know of a diverse array of worlds, ranging from gas giant planets orbiting very close to their parent stars, to smaller ice and rock planets with properties that may be closer to those of the solar system planets. Observations of eclipsing systems, in which the planet periodically passes in front of and then behind its star as seen from the earth, have given us new insight into the nature of these exotic worlds. Dr. Knutson will discuss ongoing efforts to understand the properties of several representative planets, including their temperatures, compositions, and weather patterns, as well as the prospects for studying more earth-like planets in the future.



Dr. Heather Knutson received her undergraduate degree in physics from Johns Hopkins University in 2004, and her Ph.D. in astronomy from Harvard University in 2009. She is currently a Miller Postdoctoral Fellow in the UC Berkeley astronomy department, where she studies the properties of the massive, gas-giant planets known as "hot Jupiters", as well as smaller and cooler worlds.

Dick Flask
Meeting Program Chair

Doors open at 6:45 p.m. Concord Police Association Facility 5060 Avila Road, Concord

What's Up

Solar output and climate.

by Wil Roberge

Since Galileo first observed sunspots, studies have shown the correlation between solar output and the Earth's climate. The presentation

Continued on page 8

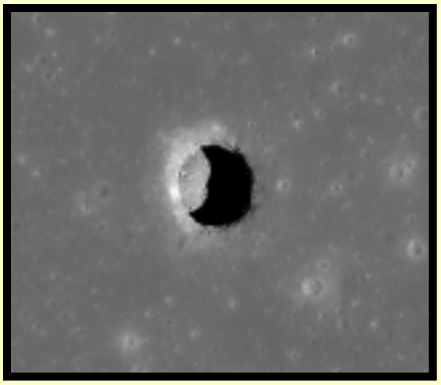
President's Corner

Interplanetary Spelunking!

by Chris Ford

One aspect of the tens of thousands of planetary images that we have captured since the 1960's is that none of them resemble the rough and craggy landscapes that astronomical illustrators once envisioned. Compared to the Earth, the considerably slower processes of surface erosion on the Moon and Mars present to us landscapes that are now extremely old, worn down, and smoothly rounded. Valleys and craters are filled with rubble and dust and until recently there did not appear to be any dark or mysterious places to explore. There is a basic primeval aspect of our human consciousness that is naturally attracted to caves and the prospect of shelter. Are there really any shadowy entrances and hidden underground labyrinths on other planets and moons to tease our imaginations? Could other worlds of our solar system possess genuine caves in which we could one day set up home?

A big part of our uncertainty is that until recently we have not had access to orbital imagery of sufficient resolution and magnification to reveal structures as small as caves. Also the liquid water processes that form many caves on Earth are totally absent on the surfaces of our neighboring planets and moons so the mechanisms that might create them are more limited. The good news is that high resolution photography has recently revealed that there are indeed caves on at least two or three other worlds of our solar system, and there is yet hope for future generations of astronaut cavemen and interplanetary spelunkers.

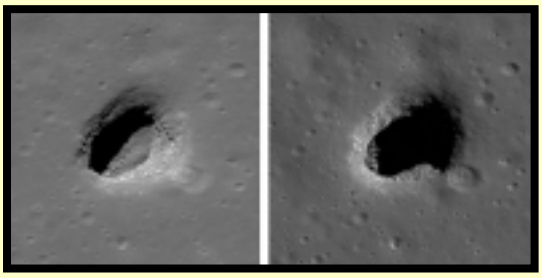


Mare Tranquillitatis cave on the Moon

The Moon:

Lets examine our nearest neighbor first. The Moon has never possessed liquid water so the process that form caves will be almost certainly volcanic or of impact origin only. Seasoned observers of the lunar surface have long been aware of sinuous rilles or long winding depressions that suggest the presence of underground tunnels. These tunnels are indeed real and are formed when lava flows underground through what are known as lava tubes. When the lava drains away it leaves behind a long hollow tube in the rock that can be tens of miles long or more. Such lava tubes also exist on Earth (In Hawaii for example) and they can be big enough to drive a car through. Many of those on the Moon appear to be significantly larger, one of the most famous being Hadley Rille a lunar channel that is a partially collapsed lava tube over half a mile wide and which was visited by the Apollo 15 astronauts. In fact the lunar valleys or rilles that we can see with our telescopes are just the collapsed visible remnant of what is very likely an entire network of hidden underground tunnels. Occasionally a meteor impact or the process of natural collapse opens up an entrance or "skylight" to this labyrinth as can be seen in the accompanying pictures.

Though it might seem that the Moon has been extensively photographed and mapped, in reality the majority of the lunar surface has not been imaged at the very highest resolutions and many more cave entrances await discovery. All of them potentially are a place for future astronauts to set up home and as they are also a refuge from harmful solar flares and radiation, knowing exactly where they are located is important.

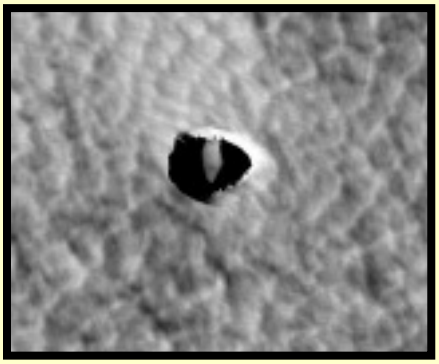


More Lunar Cave openings into underground hollow lava tubes

High resolution imagery of the Martian surface from the Mars Odyssey Orbiter is also now pro-

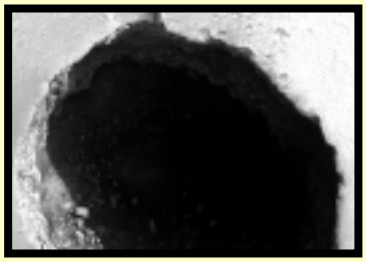
President's Corner—Interplanetary spelunking (Continued from page 3)

viding evidence of Martin caves. Unlike the Moon, we know that Mars once possessed extensive quantities of surface liquid water so it is quite possible that caves were formed during earlier times by the liquid processes that we are familiar with on Earth. Therefore, because of the greater geologic complexity of Mars, the origin of those caves that we have observed so far is less certain than that of the Moon. Some of them



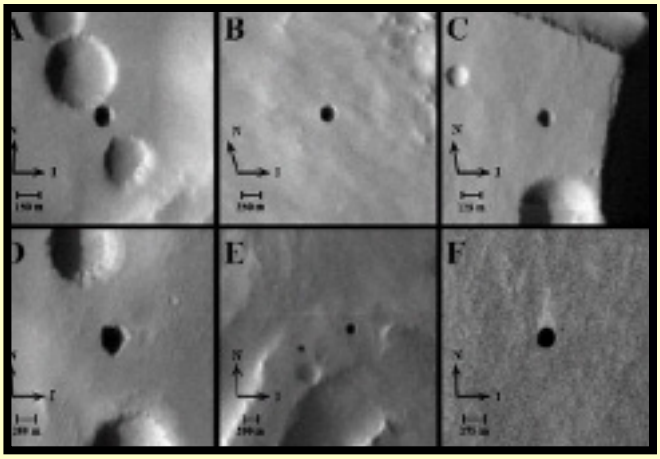
Possible opening to a sub-surface cave system on Mars.

are certainly collapse depressions or extinct lava tubes as they are located on or near Martian volcanos. One promising underground labyrinth near Arisa Mons consists of 7 "skylight" openings ranging from about 330 to 820 feet wide with one of then extending nearly 430 feet deep beneath the planet's surface. A number of similar cave openings have been located on other parts of the planet, and given that we have only examined an extremely small part of the Martian surface at high resolution, no doubt many more await discovery. Like the Moon, these caves



Another Martian cave opening

are both interesting places for future Mars astronauts to explore and are also potential safe shelters. Just as intriguingly, these caves could possibly be environments where we might find signs of microbial life, better protected from the numerous hazards of the Martian surface including radiation, extreme temperature variations, and dust storms.



7 cave openings near Arisa Mons on Mars.

What about further out in the solar system?

It appears from their very low density that some asteroids and perhaps some of the smaller outer moons are in fact "porous" with a complex sponge-like internal structure. In fact there may well be entire underground warrens inside these small low gravity bodies to explore in future.

For those larger moons of the outer solar system we do not yet have orbital imagery of sufficient resolution to show caves on their icy surfaces and the cryovolcanic processes that may form caves are still not fully understood.

However the physical principles are likely similar and there seems no reason why caves should not be present on these frozen worlds where ice essentially acts like rock. Saturn's icy moon Hyperion in particular appears to resemble nothing less than a huge sponge and it may be composed entirely of caves.

Saturns moon Hyperion.

Though the presence of caves on Hyperion is still speculative, it does appear that our companion worlds of the solar system if not as craggy and heavily eroded from the elements as our Earth, are still subject to a subset of basic geologic principles that can cause caves to occur, and that intrepid spelunkers might one day descend in lowered gravity into some of the darker and more mysterious recesses of our solar system.

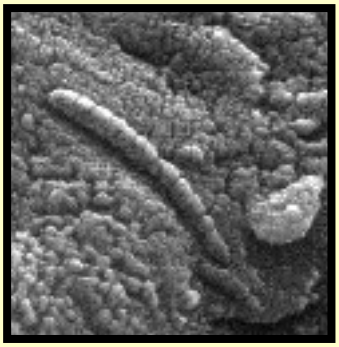
Just don't forget your flashlight

The Mars Methane Mystery

by Nathaniel Bates

The planet Mars

Mars was once viewed as a dead planet by scientists. The Viking Lander probes helped to cement the view of Mars as a planet too cold and too dry to sustain life. The Antarctica Mars meteor discovered in 1984 dramatically re-opened the question of whether or not Mars once had life. Strange markings appeared in the meteor that seemed to resemble bacterial microfossils. In 1996, the famous NASA conference disclosed the fact that scientists considered it possible that Mars once harbored some kind of life.



The elongated structure in the center maybe a microfossil

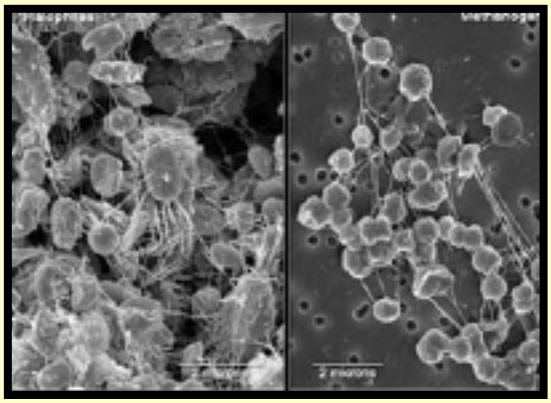
Soon thereafter, the evidence was disputed and the consensus shifted back in favor of the "lifeless" consensus. Scientists questioned whether the structures found really were bacteria. Little could be proven conclusively. The idea that Mars did have life was considered to be an extraordinary claim requiring extraordinary evidence that NASA could not provide.

Then, in 2004, the picture changed again. The European Space Agency announced the discovery of methane in the Martian atmosphere. Methane can be produced by means of volcanism.

However, Methane is also a possible sign of biological life. Indeed, methane does not last long in an atmosphere like Mars. After 300 years, X-rays would cause the Methane molecule (One Carbon atom bonded to four Hydrogen atoms) to disintegrate. Thus, any methane in the Martian atmosphere must be replenished by a constant process. Such process might conceivably be geological. However, a process that constantly replenishes the methane content of the Martian atmosphere might very well be biological.

On Earth

Methane is given off by bacteria. Animals have bacteria in the intestines that emit methane in to the atmosphere. Much has been discussed about that in light of planetary warming. Scientists note that cattle contribute a great deal to global warming due to methane emissions. Of course, this does not detract from the very real dangers of excessive carbon dioxide emissions. If anything, it shows the way in which humans have altered the landscape of Earth to a great extent in a short period of time due to cattle ranching as well as factory emissions. Again, much can be said about Archeobacteria in our intestines. However, Archeobacteria also exist in the most extreme conditions on Earth, conditions that suggest that life is durable and adaptable. The old argument that life could not adapt to conditions like those found under the surface of Mars no longer holds the weight it once did.



Microbes that Survive in Extreme Conditions

http://www.astrobio.net/press release/2172/archaea-the-bug-next-door

It is also interesting to note that scientists believe that archeobacteria are the oldest cellular life on Earth. This would suggest that they are the most "primitive" form of life, if indeed that term has any validity. If life were to have arisen on Mars, such life might have resembled archeobacteria more than it would other forms of bacteria. Such life could have arisen when Mars was warmer and wetter, perhaps during the Noachian period (4.1 to 3.7 billion years ago) when Mars may have had standing lakes and oceans. Similar archeobacteria, or "extremophiles," have shown the adaptability of life on Earth. Such bacteria have been discovered in very hot environments and in very cold environments. It is not inconceivable that extremophile organisms could continue to exist under the surface of Mars once

Mystery of the Solar System (Continued from the precious page)

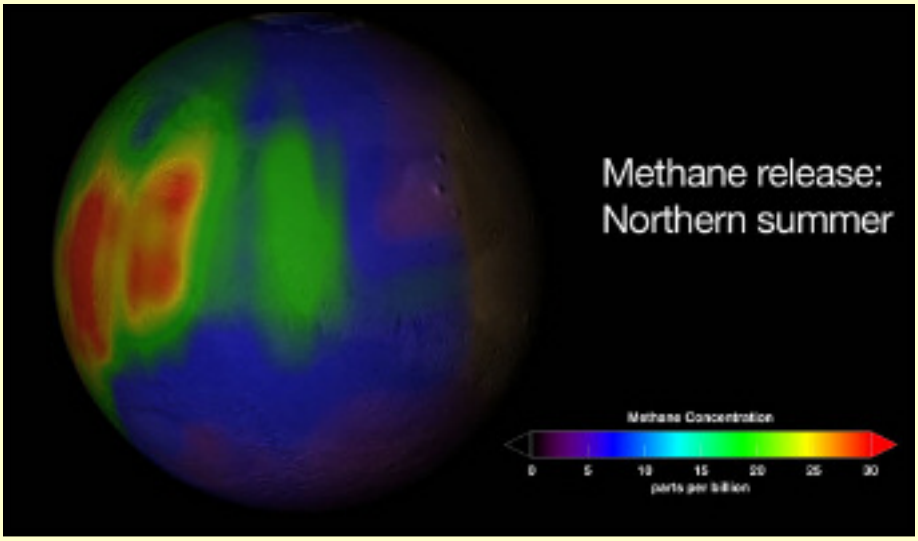
Mars made its fateful transition to being a cold world with a thin atmosphere and desert-like surface conditions devoid of any liquid water.

Distribution of methane on Mars

It is notable that they occur in concentrated areas. The methane emissions are not uniform. Such evidence might suggest volcanic origins, not related to anything biological, since volcanism occurs in specific regions and not uniformly. In science, one generally assumes the mundane hypothesis until extraordinary proof can be found verifying a more extraordinary hypothesis, and life on Mars is an extraordinary hypothesis indeed. Scientists will continue to assume that the methane on Mars is probably volcanic until more evidence can be provided for the existence of life on Mars. However, it should be known that volcanism on Mars is not a steady and reliable phenomenon. Mars is not as geologically active as Earth is. Even with a huge Volcano like Olympus Mons, Mars is still not a planet with a mantle that is as active as is the super-dynamo Earth. Earth's volcanism is enough to power a magnetic field that shields us from cosmic radiation. Mars does not have such an active mantle. For Mars to have an active methane cycle of any kind would suggest a stable process of methane emission, one that would be hard to account for if we only consider volcanism.

There is one dramatic twist in this whole debate

There is possible "smoking gun" evidence that could point to life on Mars, much as we expect on Court TV trials in which the viewer weighs evidence and comes to some kind of conclusion even before the final verdict. That would be the Deuterium question. Deuterium is an isotope of hydrogen, heavier than ordinary hydrogen due to the fact that hydrogen atoms have one proton whereas deuterium has one proton and one neutron. Life as a whole prefers lighter materials with which to work, so methane emitted by life will tend to prefer regular hydrogen to the deuterium isotope. Thus, if the methane on Mars is biological in nature, the ratio of deuterium to normal hydrogen found in the Methane may well be lower than one would normally suspect in an average statistical sample. This could be a powerful piece of evidence, one that would encourage a serious scientific expedition. Also note that deuterium has a slightly different spectral emission pattern than regular hydrogen, allowing for fairly easy differentiation.



If life on Mars is Discovered

Our view of the Universe is revolutionized. We will be forced to confront the fact that we have not only discovered extraterrestrial life, but life one on a neighboring planet. Such a radical view of our place in the Universe has ethical and political repercussions, ones that NASA will have to grapple with if there is any serious consideration to Mars colonization. What if the life in question is not simply single-celled?

Whose planet is Mars anyways?

I will leave you a coded map of the distribution of methane on Mars while you ponder these questions. The mystery under the Martian soil is also a mystery that strikes at the heart of which direction humanity will go when we finally begin expanding to the next frontier.

It's Membership Renewal Time!

by Marni Berendsen

Renew your MDAS membership and your magazines online!

ANNUAL MEMBERSHIP DUES OF $25 ARE DUE BY APRIL 1, 2011 for members on the April membership cycle. That's almost everyone. Some of our newer members renew in October, but they will be notified separately.

To renew your club membership, you may EITHER:

- Renew online using Paypal or your credit card at http://www.mdas.net/membership/paypalreg.htm#Membership_Renewal. On the same web page, please consider making an additional MDAS Donation of $10 or $15 to further support our club. Even $5 helps.
- OR if you do not have internet access or prefer not to make online payments, you may mail a check for $25 (or more!) made payable the M.D.A.S. to this address:

Mount Diablo Astronomical Society
P.O. Box 4889
Walnut Creek, CA 94596
MAGAZINE SUBSCRIPTION RENEWALS

All Sky & Telescope and Astronomy magazine subscriptions renewals are handled online – AT THE CLUB DISCOUNT RATE!

The Astronomical Society of the Pacific has made arrangements with these magazines to allow members of the NASA Night Sky Network to renew at the club discount rate. All you need is a login for the Night Sky Network (NSN) through our club.

You can log into Night Sky Network and go to the Links page to find the "New and Renewal Subscriptions" link. Here's the direct link: http://www.astrosociety.org/magazine/

If you don't have access to a computer, please renew by mail directly with the magazine using your renewal notification.

Any questions, please email memberinfo@mdas.net or call Marni Berendsen at 925-930-7431.

Officer Carl Nielson has scheduled 2 Mount Diablo State Park Docent Training Sessions.

The first is Tuesday February 22, and the second will be on Tuesday March 8. The sessions will start at 6:00 PM and last approximately 3 hours. The sessions will be held at the Mitchell Canyon Visitor Center Training Facility.

Tuesday February 22, and Tuesday March 8, 2011 6:00 PM to 9:00 PM

Mount Diablo State Park Docent Training, Mitchell Canyon Visitor Center, Clayton, CA
More details: http://nightsky.jpl.nasa.gov/club/event-view.cfm?Event_ID=25460

Mount Diablo Astronomical Society Event Calendar–February 2011

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
30	31	1	2	3	4	5 Society Observing (Private) Sunset: 5:36 PM
6	7 Board Meeting (Private)	8 MDAS Imaging SIG (Private) 6:00 PM Westwood Elementary Scien	9	10 Bayview Elementary Starpa (Private)	11	12 Sunset: 5:44 PM
13	14	15	16	17	18	19 Observatory Maintenance (Private) Sunset: 5:52 PM
20	21 Washington's Birthday	22 7:15 PM Gen Mtg: Exoplanets Docent Training Session (Private)	23	24 Morello Park Elementary (Private)	25	26 Sunset: 5:59 PM
27	28	1	2	3	4	5

Telescopes Needed

by Jim Head

Tuesday February 8, 2011, 6:00 PM - 8:00 PM

Westwood Elementary Science Fair, Westwood Elementary School, Concord,, CA Setup 5 PM

More details: http://nightsky.jpl.nasa.gov/event-view.cfm?Event_ID=24925

Thursday February, 10, 2011, 7:00 PM - 8:30 PM

Bayview Elementary Starparty, Bayview Elementary School, San Pablo, CA Setup 6 PM

More details: http://nightsky.jpl.nasa.gov/club/event-view.cfm?Event_ID=24140

Thursday February, 24, 2011, 6:00 PM - 8:00 PM

Morello Park Elementary, Morello Park Elementary School, Martinez, CA Setup 5:30 PM

More details: http://nightsky.jpl.nasa.gov/club/event-view.cfm?Event_ID=24078

Thursday March, 10, 2011, 7:00 PM - 9:00 PM

Timber Point Starparty, Timber Point Elementary School, Discovery Bay, CA Setup 6 PM

More details: http://nightsky.jpl.nasa.gov/club/event-view.cfm?Event_ID=23715

Board Members & Address

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Vice President
Rick Linden - Rick.C.Linden@gmail.com

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Marni Berendsen - berendsen@aol.com

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Dick Flasck - rflasck@aol.com

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Jim Head - jamesnhead@comcast.net

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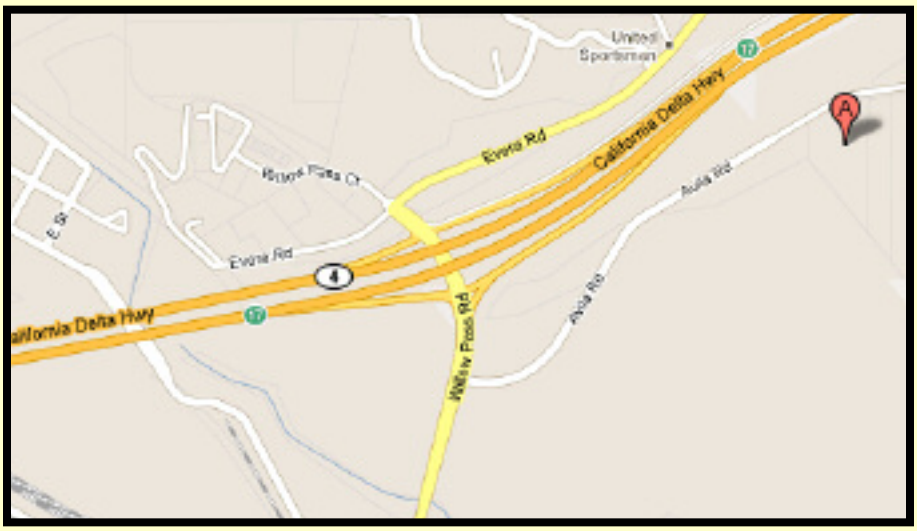
Glenn Spiegelman - gspie@comcast.net

Secretary and Refreshments
Moon Trask - metallicamoon@sbcglobal.net

New Member Steward
Nick Tsakoyias - claytonjandl@aol.com

Mailing address:
MDAS
P.O. Box 4889
Walnut Creek, CA 94596-
General Meetings:
Fourth Tuesday every month,
except on the third Tuesday
Refreshments and conversations
Meetings begin at 7:15pm.
Where:
Concord Police Association
5060 Avila Road, top of the
Take Avila Road from Willow
Directions to facility:



What's Up

Continued on page 8

will be an update on these studies and the response of the scientific community.

Henrik Svensmark, who believed he had validated his theory with a lab experiment, had obtained authorization to test his thesis at CERN that cosmic rays encourage nucleation leading to upper atmosphere cloud formation, and thus increasing the reflectance of the atmosphere.

Cosmic rays can more easily reach the upper atmosphere during periods of low solar output, and he believes that such actions in the upper atmosphere provide a mechanism to explain the relationship between solar output and earth's climate.

This update will attempt to track his difficulties in obtaining time and funding for his experiment at CERN as well as to comment on the reaction of the climate study community on those who try to explain the observed close relationship over time between solar output and earth's climate.

Visit to the USS Hornet

by Ken Coates

I recently visited the USS Hornet in Alameda. The Hornet is a WWII era aircraft carrier that has been turned into a floating museum. It is permanently docked at the north end of the island.

The Hornet has a very important place in man's exploration of space. It was on the deck of the Hornet that Neil Armstrong, Buzz Aldrin, and Michael Collins first stepped when they returned from their trip to the Moon in Apollo 11.

In fact you can see outlines of their footsteps on the hanger deck of the Hornet as they walked towards the isolation trailer known as the "Mobile Quarantine Facility".

The Hornet also retrieved the Apollo 12 crew. So you can walk in the footsteps of the first four people to have walked on the Moon.

There is lots of space memorabilia on display:

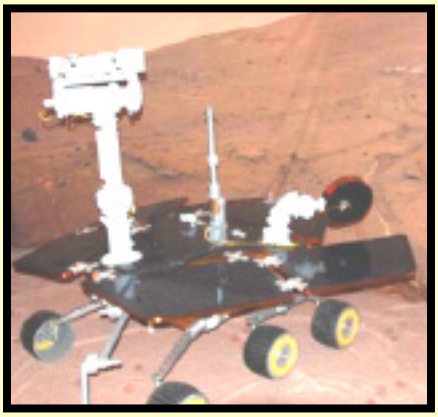
The main reason for my visit was to see a full size replica of the Mars rovers Spirit and Opportunity. They are the size of a small golf cart:

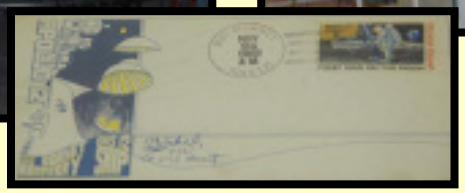
The Mars Rover exihibit is on display at the USS Hornet through March 31, 2011.

For more information visit: http://www.uss-hornet.org/

I recommend visiting on "Living Ship Day". They operate the plane elevator up and down from the hanger deck to the flight deck and you can go along for the ride! http://www.uss-hornet.org/calendar/liveship/

This year is the 100th anniversary of naval aviation. The first plane to successfully land on a ship did it on January 18, 1911 in San Francisco Bay. http://www.public.navy.mil/airfor/centennial/Documents/1st%20Centennial%20Newsletter.pdf





Rewarding Opportunities for Astronomy Enthusiasts and Observers

by Jim Head

The Mt. Diablo Astronomical Society coordinates many activities for the benefit of its members and the public, such as star gazing events and presentations, often using new methods to present basic astronomy concepts with toolkits from the Night Sky Network. All together, our club reaches about 3000 folks annually, with the help from many gracious members who volunteered their time and energy to participate in exciting events for school groups and the public. Last year there were 26 members who helped with 5 events or more:

Marni Berendsen
Thomas Boltz
Jack Borde
Kenneth Coates
Pam Cowart
Robert Cowart
Rich Girard
Jim Head
Jim Holmes
Linda Jacobs
Steven Jacobs
Randy John
Liede-Marie Haitsma
Mike Harms
Jonathan Keith
Rick Linden
Michael Hanley
Ralph Lambert
Richard Ozer
Chris Peterson
Ralph Requa
Vianney Serriere
Mark Stafforini
Malinda Trask
Nick Tsakoyias
Jon Wilson

This is a tremendous level of participation, and is one of the major reasons the Mt. Diablo Astronomical Society is a success.

Why are we so motivated?

Perhaps you had a chance to read the recent survey revealing our student's poor science knowledge: Sixty-six percent of 4th graders, seventy percent of 8th graders, and seventy-nine percent of 12 graders failed to show proficiency in science. Many couldn't explain the difference between a star and a planet! Some educators feel that the emphasis on math and reading, at the expense of science, was the main reason. Another contributing factor could be the concentration of learning facts, greatly reducing or eliminating entirely essential hands-on activities, in an effort to increase a school's aggregate test score. It is evident that science has not been one of the priorities of the United States education system. As a result, students are science starved, disenchanted, often even depressed! Needless to say, future world competition could become a looming problem.

Photo from the Contra Costa Times

YOU can make a difference!

Showing the stars and explaining what we know of the Universe at our star gazing events can greatly enhance a child's outlook of life on this planet! Together we are helping the student understand the world they live in, providing insight they otherwise would not likely attain.

Many believe that understanding the basic structure of their surrounding environment – our Universe – greatly improves learning across a wide variety of curriculum. Ultimately, many poor decisions are made at all levels in our society because of a basic lack of scientific understanding, and I would suggest that some less-desirable outcomes could be the result of never having the opportunity to look through a telescope at a young age!

Rewarding Opportunities for Astronomy Enthusiasts and Observers

We could reach more of the public if we had more volunteers.

It is difficult to predict the turnout for some of our events. For reasons beyond our control, we sometimes have dozens of students waiting their turn at the telescope. It would be a great addition to our team if there were a member that could simply point out stars and constellations during the wait for a view through the eyepiece. Also before night events, or at fairs, and some daytime school events, a telescope equipped for solar viewing would be most welcome. In the not too distant future our members will setup videocams hooked to the focuser, such as the "Mallincam", that can multiply photons and display color images in near real-time, providing another fantastic perspective showing what a telescope can do.

There are many astronomy aids to help the first time or experienced outreacher. The Night Sky Network has many activities and toolkits developed by scientists that are peer reviewed and field tested, assuring a low-effort method to explain basic astronomy concepts in a fun and entertaining way. There are also many props that can coordinate observing activity at the telescope with the presentation given before nightrise that same evening, such as correlating the size of our Solar system as a twenty-five cent quarter, and the Milky Way galaxy to the North American continent, with similar distance scales to nearby stars shown through a telescope.

If you enjoy astronomy, and want to make a difference:

One of the most rewarding experiences is seeing another mind in the act of discovery. Your first step in achieving that goal is to add yourself to the outreach group today – it's free, and if you are lucky enough to get a chance to volunteer it can be tremendously rewarding -- for you and the student!

Here are some useful videos on what can happen at a starparty: http://www.astrosociety.org/SharingTheUniverse/outreach-training.html